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Process for the preparation of film sheets

The invention concerns a process for the preparation of sheets, that contains the following characteristics of the process:

- extruding a film tube
- laying the film tube flat and squeezing it
- reversing the film tube
- cutting the extruded film tube

Processes of this kind are used usually in connection with tubular film extrusion plants. Often a film tube is extruded, laid flat, squeezed and subsequently fed to a winding equipment. It is particularly mentionable that the tubular film sheet usually runs through a so-called reversing device after the squeezing.

All afore-mentioned functional units are known in published form. Thus e.g. the DE 100 40 055 lays claim to such a reversing device and also shows the associated squeezing and lay-flat (flattening) devices.

In order to transform the film tube into film sheets one uses different types of cut-off devices that are attached to the winding equipment and transform the tubes into film sheets immediately before the beginning of the winding process. Usually for this purpose trimming sections are arranged at both the edges of the collapsed film tube. This process however results in a lot of wastage. Since modern standard procedures however allow for an exact adjustment of the diameter of the extruded tubular film and the breadth of the collapsed film tube, in many cases a trimming section is not used. Instead of that cleavers are attached to the winding equipments that slit open the collapsed tubular sheet directly at its edges and thus avoid unnecessary wastage.

This type of the production of sheets from film tubes is however not suited for thin sensitive or sticky films. These films are affected by the action of the cleaver on the collapsed film tube. Films of the aforementioned type are thus still prepared with the help of trimming sections that are put on the film after the film has run through the reversing device.

Therefore the task of the present invention is to suggest a process that makes trimming sections redundant and contains the costs of the device.

The task is solved by the fact

- **that** the film tube is cut in the conveying direction of the film tube (z) before the squeezing takes place and
- **that** at least one resulting sheet runs through only one reversing device before it is fed to a stationary processing device or storage device.

Through this measure the aforesaid cut-off device can cut the film tube while air is still present in the film bubble, so that no damage of the interior surface of the film tube occurs when the blade cuts through the film and interpositions in the internal space of the film tube.

Further preferential design forms of the process for the production of sheets have a reversing device that reverses the sheets that result from the cutting process, as they lie flat on each other.

In the production of bonding films it is particularly advantageous if the sticky film layer forms the outer circumference of the extruded film tube. In this way the sticking of both the sheets is avoided particularly during their common transport through the reversing device.

Further design forms of the invention are based on the drawings and the graphic description.

The individual figures illustrate:

- Fig. 1 A complete view of a device in which the film is cut before it reaches the squeezing device.
- Fig. 2 A side view of this device
- Fig. 3 A side view of a device in accordance with the invention.

The figures 1 and 2 illustrate a device that among other things has a flattening device 2, a cut-off device 4 and a squeezing device 3. Since the cut-off device 4 is illustrated in front of the squeezing device 3 the film can be cut before the due reversing process.

In the conveying direction z the development of the tube is described as follows:

The film tube 1 that is extruded from a tubular film extrusion unit (not illustrated in the figure) usually has a circular profile. A flattening device 2 is attached in the transfer direction z. This flattening device 2 compresses the profile successively from two opposite sides. Behind the flattening device 2 the film tube 1 is led through a presqueezing device 6. The associated pre-nip rollers 16 and 26 are distanced from one another such that the straight sides of the film tube 1 do not lie on each other yet. An air cushion remains in the film tube 1 through the squeezing process that is not yet complete. The figure also illustrates an attachment of two cut-off devices 4, 5. These cut-off devices 4, 5 each contain a blade 8. The blades 8 are attached to the machine frame in a manner that is not illustrated more elaborately in the figure. These blades 8 are arranged such that they slit open the film tube 1 at its end roundings. In the further course of the process the sheets 7, 17 resulting from the slitting run through the squeezing device 3 that consist of two nip rollers 13, 23. This device serves to press both the sheets 7, 17 flatly on each other and thus prevent the inclusion of air between both the sheets 7, 17. For the purpose of clarification the sheets 7, 17 are illustrated in

figure 1 as diverging from each other. But when they are fed to the reversing device they lie flat on each other as illustrated in figure 3.

A suitable reversing device is described in detail in e.g. the published documents DE 100 40 055 A1. The common leading of both the films lying on each other into a reversing device is basically also possible in another reversing device.

The side view of the device in accordance with the invention illustrated in figure 2 clarifies the lay-flat process of the film tube in the flattening device 2 of which only the two sides of the flattening plates 12, 22 can be seen. It can be clearly seen that the connecting pre-nip rollers 16, 26 have a fixed distance between each other. This distance is selected among other things depending on the operating parameters such that one more air cushion exists inside the film tube at the height (level) of the cut-off device 4. Due to the air cushion the parts of the film tube 1 that form the sheets 7, 17 after the slitting have a somewhat larger distance between each other than while running through the squeezing device. The nip rollers 13, 23 prevent air from escaping through the squeezing device 3. In this manner the film tube can also be slitted laterally without the risk of damaging very thin or sticky sheets 7, 17 from contacting the blades 8.

The devices illustrated in the figures disclose a particularly advantageous method to cut the film tube 1 before reaching the squeezing device 3. However it is also possible to cut the film tube before the squeezing device 3 without providing a presqueezing device 6.

Figure 3 illustrates once again the device illustrated in figure 2 whereby a reversing device 100 is depicted. After the sheets 1, 17 have run through the squeezing device 3 they run together past the lead rollers 101, the first deflecting roller 102, the first air turning bar 103, the second deflecting roller 104 and the second air turning bar 105. Finally the sheets 7, 17 reach the outfeed roller 106, which is a stationary roller that does not participate in the reversing process. Subsequently the sheets 7, 17 are fed to further processing devices or storage devices (not illustrated in the figure). The distance between the sheets 7, 17 from the squeezing device is illustrated as rather large in order to clarify that they are two sheets. During the winding process of the sheets, they can be wound up individually or together.

At this juncture it should be mentioned once again that figure 3 illustrates only the basic layout of a very advanced reversing device whereby the attachment of the sketched film lead elements 101 to 105 and also the actual reversing process that happens through reversing movements of the rollers and bars 103 to 105 around a vertical axis, is not illustrated. The process in accordance with the invention however encompasses all reversing processes.

Moreover it must be emphasized once again that reversing devices with differing numbers on deflecting rollers 102, 104 and air turning bars 103, 105 are also known. In this connection reference is made once again to published documents such as the DE 100 40 055, DE 43 03 952 or EP 0 873 845.

Particularly advantageous are reversing devices whereby one turning bar and one deflecting roller form a functional pair. In such functional pairs one deflecting roller and one turning bar carry out a reversing movement that takes place in relation to an axis that runs orthogonal to the rotational position of the deflecting roller around its axis of main symmetry. By all rules this axis is vertical and aligned with it in the main conveying direction of the film. Reversing devices with one, two or even three functional pairs are known. The word functional pair and its meaning for the described reversing devices are explained in the application DE 100 40 055.

	List of reference symbols
1	Film tube
2	Flattening (lay-flat) device
3	Squeezing device
4	Cut-off device
5	Cut-off device
6	Presqueeze device
7	Sheet
8	blade
9	Static air cushion
10	Arrow in the conveying direction of the film tube
11	
12	Side bar
13	nip roller
14	
15	
16	Pre-nip roller
17	Sheet
18	
19	
20	
21	
22	
23	nip roller
24	
25	
26	Pre-nip roller
100-106	Film leading elements
z	Conveying direction of the film tube